handover to C2; at P4,C2 handover to C3; at P5,C3 handover to C4; and finally, in C4 handover to C3 (prior to arriving at office).

[0104] Upon using at least some aspects of the UMAA-MRO algorithm presented herein, through route pattern match in the UMD, C1 will find C3 as a destination in the time period (morning). So it will first choose C3 as TeNB under conditions permitting. The handovers may be: at P2,C1 handover to C3; at P3,C3 handover to C2; at P4,C2 handover to C3, end. So, in the same route to work at office, the number of handovers is reduced to three.

[0105] The implementation of the procedure in line with the algorithm will cost some computing power and storage capacity, and compared to standard HO process, it adds four messages (as shown in FIG. 4). But compared to the cost of unnecessary HOs and failure HOs, it is worth to be used. The lives of most people are regular, so their mobile routes are regular. The procedure helps us to find these regularities, to exploit them to reduce HO number in the routes and to provide more precise parameters for users. Through analyzing users mobility data, inventors investigations and experiments revealed that at least 20% HOs can be omitted and 10% HO failures can be avoided.

[0106] In the process, we use a threshold to limit the cell number in a user's graph, and use an index to speed up the search. There are two main procedures: update user mobility graph, search optimal solution in the graph. For both of them, the time complexity is O(1). The space complexity is O(n), n is number of users. For each user, there is a directed graph of cells (vertices) and HOs (edges) with their attributes. The cell number is limited by CN_{th}; the edge number is limited by CN_{th} and cell neighbour number (e.g. it is six in FIG. 1). So the space for a user can be calculated. For example, if we use 100 bytes for one cell info storage, and 100 bytes for one edge info storage; if the CN_{th}=40, and the neighbour number is six, so the graph size for a user is about $40\times100+40\times6\times100\approx28$ Kbytes; for a city of 1 million people, considering indexes, the UMD storage space is about 30 G bytes. The CN_{th} should be selected according to real environments, which will improve the algorithm performance.

[0107] FIG. 6 shows a basic block circuit diagram of a network entity such as a eNB or MME, in which embodiments of the present invention are implemented. Thus, the entity 4 can be a HeNB, a SeNB or a TeNB, and may also unite HeNB/SeNB or HeNB/TeNB properties/functionalities in some scenarios.

[0108] The eNB/MME, denoted by numeral 4, comprises a interface, Tx/Rx, cf. numeral 43, for transmission to/reception from another network entity e.g. another eNB and/or a UE. The interface is bidirectional connected to a control module or unit such as a processor, e.g. a digital signal processor, DSP, or ASIC (ASIC=application specific integrated circuit), CPU (central processing unit), or the like, denoted by numeral 42. The control module or unit (aka controller) is bidirectional connected to a memory module or unit (aka memory) MEM, denoted by numeral 41. The memory module can be any type of memory to which data can be written and from which data can be read, e.g. a Flash memory, RAM (Random Access Memory), or also EPROM (Electrically Programmable Read Only Memory). The memory module is configured to store at least data necessary for implementation of the invention, e.g. control code, acquired and/or processed data to be used for implementing/realizing at least aspects of the invention, and in this regard in particular the UMD or parts thereof in case of a distributed UMD architecture.

[0109] Thus, the memory module can be a separate memory module or a partition of a memory module storing also other user/control data handled by the eNB/MME. Other memory modules may be present, too, in the entity. Examples of the invention can be embodied in an apparatus or unit of the eNB/MME, e.g. denoted by numeral 40, comprising at least the modules 42 and 41 above.

[0110] Insofar, as described herein above and as derivable there from, the present invention, according to at least some aspects thereof, encompasses:

[0111] in terms of e.g. a HeNB and/or UMD,

[0112] an apparatus, comprising a memory unit; and a control unit connected to the memory unit and configured to interface at least one other apparatus, wherein the memory unit comprises a plurality of partitions, each assigned to a respective terminal, each partition comprising a first plurality of subpartitions of a first type, each assigned to a respective cell visited by the respective terminal, and a second plurality of subpartitions of a second type, each assigned to a respective transition of a terminal between respective cells, and wherein the control unit is configured to receive, upon each transition of a respective terminal between respective cells, data pertaining to the respective terminal from at least one network entity representing a respective cell, and responsive thereto, to store, in each subpartition of the first type, statistical information pertaining to the terminal in relation to that cell; and to store, in each subpartition of the second type, information pertaining to the respective transition of the terminal;

while further subaspects thereof involve that

[0113] the statistical information stored in each subpartition of the first type comprises at least one of time period of a visit of that cell by the terminal and frequency of visits in that cell by the terminal;

[0114] the information pertaining to the respective transition of the terminal stored in each subpartition of the second type comprises at least one of a frequency of handover transitions of the terminal, and one or more handover parameters of time to trigger, hysteresis, cell individual offset, cell reselection;

[0115] the control unit is configured to modify, upon each transition of a respective terminal between respective cells, at least one of the data received for being stored and the data already stored in each subpartition of the second type, based on quantities affecting communication;

[0116] the quantities affecting communication are one or more of a terminal speed, weather conditions, a terminal's user's habits;

[0117] the control unit is configured to receive a report from another apparatus indicative of a failure type of a transition of a terminal, and responsive thereto, update information stored in each subpartition of the second type based on the reported failure type;

[0118] the control unit is configured to add a new subpartition of the first type responsive to a detection that a cell is visited by the respective terminal for the first time;

[0119] the first plurality of subpartitions of a first type is limited to a first number, and the control unit is configured to detect that the plurality of subpartitions of the